

In the claims:

1. - 38. (Cancelled)

39. (New) A seal element for providing a seal between components in a downhole tool system, the seal element comprising:
an elastomer host material; and
a nanomaterial integrated with the elastomer host material to form a nanocomposite material, the nanomaterial selected from carbon nanotubes and carbon nanofibers.

40. (New) The seal element as recited in claim 39 wherein the elastomer host material further comprises a copolymer of acrylonitrile and butadiene.

41. (New) The seal element as recited in claim 39 wherein the elastomer host material is selected from the group consisting of nitrile butadiene, carboxylated acrylonitrile butadiene, hydrogenated acrylonitrile butadiene, highly saturated nitrile, carboxylated hydrogenated acrylonitrile butadiene, ethylene propylene, ethylene propylene diene, tetrafluoroethylene and propylene, fluorocarbon and perfluoroelastomer.

42. (New) The seal element as recited in claim 39 wherein the nanomaterial have a length in the range of approximately 0.1 nanometer to approximately 500 nanometers.

43. (New) The seal element as recited in claim 39 wherein the seal element comprises a seal selected from the group consisting of O-ring seals, D-seals, T-seals, V-seals, X-seals, flat seals, lip seals, back-up rings, bonded seals and packing elements.

44. (New) The seal element as recited in claim 39 wherein the elastomer host material and the nanomaterial have interfacial interactions.

45. (New) The seal element as recited in claim 39 wherein the nanomaterial structurally and chemically complement microporosity within the elastomer host material.

46. (New) A seal element for providing a seal between components in a downhole tool system, the seal element comprising:
an elastomer host material; and
a nanomaterial integrated with the elastomer host material to form a nanocomposite material, wherein the nanomaterial is a nanoclay.

47. (New) The seal element as recited in claim 46 wherein the elastomer host material further comprises a copolymer of acrylonitrile and butadiene.

48. (New) The seal element as recited in claim 46 wherein the elastomer host material is selected from the group consisting of nitrile butadiene, carboxylated acrylonitrile butadiene, hydrogenated acrylonitrile butadiene, highly saturated nitrile, carboxylated hydrogenated acrylonitrile butadiene, ethylene propylene, ethylene propylene diene, tetrafluoroethylene and propylene, fluorocarbon and perfluoroelastomer.

49. (New) The seal element as recited in claim 46 wherein the nanomaterial is a montmorillonite nanoclay.

50. (New) The seal element as recited in claim 46 wherein the nanomaterial have a length in the range of approximately 0.1 nanometer to approximately 500 nanometers.

51. (New) The seal element as recited in claim 46 wherein the seal element comprises a seal selected from the group consisting of O-ring seals, D-seals, T-seals, V-seals, X-seals, flat seals, lip seals, back-up rings, bonded seals and packing elements.

52. (New) The seal element as recited in claim 46 wherein the elastomer host material and the nanomaterial have interfacial interactions.

53. (New) The seal element as recited in claim 46 wherein the nanomaterial structurally and chemically complement microporosity within the elastomer host material.

54. (New) A seal element for providing a seal between components in a downhole tool system, the seal element comprising:
a thermoplastic host material; and
a nanomaterial integrated with the thermoplastic host material to form a nanocomposite material, the nanomaterial selected from carbon nanotubes and carbon nanofibers.

55. (New) The seal element as recited in claim 54 wherein the thermoplastic host material is selected from the group consisting of polphenylene sulfide, polyetheretherketones and polytetrafluoroethylene.

56. (New) The seal element as recited in claim 54 wherein the nanomaterial have a length in the range of approximately 0.1 nanometer to approximately 500 nanometers.

57. (New) The seal element as recited in claim 54 wherein the seal element comprises a seal selected from the group consisting of O-ring seals, D-seals, T-seals, V-seals, X-seals, flat seals, lip seals, back-up rings, bonded seals and packing elements.

58. (New) The seal element as recited in claim 54 wherein the thermoplastic host material and the nanomaterial have interfacial interactions.

59. (New) The seal element as recited in claim 54 wherein the nanomaterial structurally and chemically complement microporosity within the thermoplastic host material.